

The chain cutter occupies a position midway between these two and while supposed to have none of the disadvantages of the other types, appeared in a number of cases in the early days like having very few of their virtues either. Through experience it is not a type that is particularly popular in most coal fields in Britain, but having been better designed has been very successful in the United States. This type of cutter using the travelling chain has one main advantage over the disc, for being narrower in the cut and being able to cut its way into the coal itself in a similar manner to the bar.

Machine mining it is understood has the following general economies:—

(a). A much increased output is obtained from the same area.

(b). The undercutting cost is less, by the large increase of output per man.

(c). Owing to better and advantageous control of the roof, the cost of timbering and explosives are both reduced.

(d). Better coal is produced, less slack being cut by the machine in comparison with hand mining.

(e). There is greater safety at the face.

Changed Conditions in the Mines

The most important point is the recognition by management and men of the changed conditions introduced in the mine. The following remarks, apply equally well to conveyor and loader conditions:

The Workings.—As the conditions which prevail under hand mining are in the majority of cases quite unsuited to machine work, the workings must be properly prepared before commencing. Everything possible to expedite this should be done, for with machines a certain amount of work has to be carried out within a definite time. The men must be well arranged and know exactly what is required of them. The roads should be short and well graded, as about three times the tonnage has to be handled with certainty under the new conditions. If the regularity is not maintained, a loss of a night's cut is the usual penalty, and a succession of such defaults will soon make the machine a costly innovation.

Opening Out Machine Walls.—Opening out machine walls if done by hand is slow and tedious work, and in modern practice the machine itself is frequently used either by running a bar and increasing the face in a semicircular form, or using a disc and carrying a short machine wall direct to the dip. In a face of this character one end of the wall should be in advance of the other so that any water made will gravitate to one point in the workings. By making the machine operate with a deep cut in these short opening out walls, the coal is easily broken down and a considerable tonnage results.

Depth of Undercut.—This is a matter of experience and opinion, and is mainly governed by the best depth at which the coal will break easily yet not too readily, so as to avoid any breakage of the coal in top of the machine. Three feet three inches is a common undercut, but with American chain machines six ft. is more usual.

Holing.—As a rule this is done in the bottom of the seam, for the same reason that the miner undercuts there, taking advantage of the roof weight. Holing in any dirt band that may underlie the coal is not always advisable, as it sometimes leads to trouble in filling; and except in very thin seams where height is much needed, holing is best done in the coal. Cer-

tain conditions such as a band of bad coal, a soft clay higher up in the seam, may cause holing to be done there; but care should be taken that the portion below the holing has a good parting from the floor. Otherwise trouble will result in lifting this pavement coal.

Working Operations.—The usual practice is to undercut at night, the coal being filled during the day. Machines can cut two ways: back and forward each alternate night, and a certain length of face; or only in one direction, the machine being run at the end of the shift from one end of the section to the other. This latter part of the work known locally as "flitting the machine" is an awkward and costly operation, and is seldom applied now-a-days unless in thick seams where it takes more than one shift to clear away the coal. In some collieries where conditions are good, as many as five cutters follow each other in regular succession over one long face.

Height.—This condition only applies where thin seams are operated, and when it gets down to 18 and 20 in. sections every inch counts. By using skids a few inches is gained over wheels. With thin sections the cutting must be kept at the pavement since any coal left has to be afterwards lifted in order to maintain the height causing extra work. In using coal cutters in thin seams provision should be made for any likely decrease in section.

Operating.—In getting ready to start cutting, the coal face from end to end should be as straight as possible. Usually, however, a longwall face gradually assumes an almost semi-circular form, and where the outlet road of the section is in the centre this form suits just as well, although it is apt to cause faults in the roads owing to the tendency of the lines of roof pressure to converge. A straight line face permits of the weight being more evenly distributed and brings down the coal in a regular manner. Seams exist where the pressure can be regulated, so as to allow the coal to fall without blasting a few yards behind the machine. Timbering should also be regular, each prop being a measured distance from the coal and from the next in line.

Direction of Working Face.—This is mainly determined by the inclination, except in those cases where the cleat of the coal is extra well developed. As a general rule undercutting by machine is independent of the advantage of cleats owing to the use made of the roof weight. Usually a machine is run on the dip to rise run; but it sometimes happens that, at right angles to this, if not too steep, or any angle between the two, the coal may break out easier in large blocks, and so reduce the small coal to a minimum.

The Length of Face.—The amount of coal to be stripped off chiefly determines the length of the wall, together with the time that can be given to doing it. Where a machine cuts the coal every night, the length must be such that there can be no doubt but that the coal can be cleaned away rapidly in the following day shift. What is called back or after stripping is to be avoided, and sometimes too long a wall leads to the waste of much coal being thrown out of the way to allow the machine to proceed.

Stripping.—Steady men should be employed to work as loaders and provision should be made to always have some reserve of men to draw on. Loading should commence in the road head by a breaking in shot and after that work continues filling out each day. The space allotted to the pair of men should only be